

CHAPTER B

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B.00 General

The information contained in this chapter is covered by the "B" Family, Rigid Roadbed.

Detailed description of activities included in this "Family" are contained in Volume 2 of the Maintenance Manual.

B.01 Definitions

A rigid roadbed is a roadbed surfaced with Portland cement concrete (PCC). Portland cement concrete pavement surfaced with less than 2 inches (50.8 millimeters) of asphaltic concrete (AC) is also included under rigid roadbed.

The roadbed is that portion of the roadway, including ramps and public road approaches, that extends from curb line to curb line or shoulder line to shoulder line, including dikes. Divided highways are considered to have two roadbeds.

B.02 Maintenance Levels

The general objectives of roadbed maintenance are to provide safety, preserve the State's capital investment, and maintain a riding quality satisfactory to the traveling public. Maintenance of the roadbed covers the restoration and repair of both surface and underlying layers.

Typical items to be considered in roadbed maintenance are slippery pavement, proper drainage, cracking, shoulder drop-off, slab warp, spalling, slab settlement, heave or distortion, bridge approach settlement, base failure, joint separation, checking, joint sealing, and abrupt vertical surface differential.

Roadbed deficiencies that immediately affect safety should be given first priority in roadbed maintenance. Typical defects in this category are slippery pavement, excessive bridge approach slab settlement, abrupt vertical variations, and debris on the traveled way.

Second priority should be given to the correction of roadbed defects having a long-range effect on riding quality and capital investment. Typical examples of defects in this category are pavement cracks, pavement and surfaced shoulder distress, and spalls.

The following summaries identify typical examples of defects and required levels of maintenance.

(A) Slippery Pavement

Pavement surface texture is subject to adverse change as a result of aging, wear, etc. Routine surveillance of pavement texture should be made and suspected problem areas reported promptly.

Obvious slippery areas should be corrected to the extent feasible under the prevailing conditions. When additional corrective action is necessary, it should be initiated or scheduled promptly.

Suspected slippery areas should be promptly reported for further investigation.

(B) Cracks

Cracked pavement allows water and foreign material to enter the structural section and may cause ultimate failure.

Individual cracks 1/8 inch (3 millimeters) wide or wider and any other areas with extensive finer cracking should be repaired before the rainy season to protect the structural section.

(C) Settlement, Heave and Distortion

This type of roadbed defect often results in poor riding quality and excessive impact loading of bridges and slabs. It does not always involve failure of the structural section. Typical causes are fill-settlement, unstable cuts, expansive soils, and unconsolidated basement soil. This type of defect may not cause any problem at low speed but would be objectionable at high speed.

Surface irregularities and vertical edges create a rough riding quality. Many surface variations are not as obvious to the driver at high speeds as they are at low speeds.

Correction for surface irregularities should be scheduled when the surface deviation reaches 1 1/2 inches (38.1 millimeters) in a length of 50 feet (15.24 meters) or when the riding quality is objectionable.

Differential changes in elevation of individual PCC pavement slabs, also result in poor rideability and accelerate pavement deterioration due to increased impact loading. When surface deviations exceed 1/2 inch (12.7 millimeters) between adjacent slabs, corrections should be scheduled. A repair should be scheduled when an abrupt vertical differential between the traveled way and paved shoulder results in poor riding quality.

Bridge approach slab settlement is a problem requiring routine surveillance. A void often exists under a PCC approach slab long before the slab settles. Slab settlement can often be prevented by early detection and filling of voids.

An exploration should be made within a year after construction to assist in early detection of voids under bridge approach slabs. Voids that are discovered should be filled. Since some voids occur several years after construction, a continuing visual inspection is necessary for signs of voids under approach slabs such as springiness or separations at the edge of PCC pavement.

(D) Spalling

A transverse spall in PCC pavement that exceeds 4 inches (101.6 millimeters) in length in the direction of travel or adversely affects comfort should be repaired. Longitudinal spalls that adversely affect riding quality should be repaired.

(E) Joint Separation

Joint separation in PCC pavement allows water to reach underlying structural layers. This often results in a rocking slab with subsequent pumping of underlying materials through the joint and ultimate slab failure.

Joint separation between PCC pavement and adjacent AC shoulders is detrimental as it allows surface runoff to penetrate the structural section and often causes shoulder failure. In addition, it provides space for growth of objectionable vegetation.

Joints in PCC pavement and shoulder joint separation between PCC pavements and AC shoulders that exceed 1/8 inch (3 millimeters) should be filled.

(F) Dikes and Berms

Asphaltic Concrete dikes and earth berms control roadbed runoff and protect slopes from erosion. Extensive damage to the roadway may result when these are not maintained as built.

Damaged dikes and berms, which will allow runoff to erode the roadway should be repaired promptly, or temporary repairs should be made until permanent repairs can be scheduled.

Damaged dikes and berms not falling under the above category should be routinely repaired in conjunction with other maintenance operations to minimize traffic disruption.

Asphaltic Concrete dikes and penetration-treated berms in areas where asphaltic material is subject to rapid oxidation or freezing conditions, should be inspected annually and sealed upon evidence of raveling, cracking, or other surface deterioration.

B.03 Definition of Traveled Way

The traveled way includes both surface and base of the roadway within right-of-way lines that is for the movement of vehicles. It includes the area between the inside of curbs where curbs exist, county road approaches, and city street intersections-between right-of-way, lines

B.04 Policy for Performing Roadbed Maintenance Work

Refer to Chapter A. Section A.03 for the policy for performing roadbed maintenance work.

B.05 Surface Types

Rigid Type Surfacing includes all Portland cement concrete (PCC) pavement including concrete pavement with less than 2 inches (50.8 millimeters) of asphaltic concrete (AC) surfacing overlay.

As listed in the California State Highway Log, the following surface is rigid pavement:

Surface Types (Rigid)	
CODE	TYPE
ST	Surface Type
C	Concrete (less than 2 inches AC surface) (50.8 millimeters)

B.06 Types of Rigid Roadbed Failures

Rigid Roadbed will fail by any one or a combination of the following:

- (A) Cracking may be due to either failure of the base or temperature expansion and contraction.
- (B) Slab sinking, is caused by base failure or movement of the earth mass beneath the pavement structure.
- (C) Raised joints are generally caused by curling of the pavement slab or faulting at the joint.
- (D) Faulting refers to vertical displacement of concrete pavement slabs at joints.
- (E) Spalled joints are caused by a joint surface edge breaking, resulting in a hole in the pavement surface at a joint.
- (F) Surface spalling may be caused by freeze thaw cycles or by the continued use of metal coming in contact with the pavement surface such as vehicles using tire chains.

B.07 Rigid Pavement Repairs to Portland Cement Concrete Pavement Using Asphalt Materials

Asphalt plant mixed material may be used for many surface repairs to rigid pavement. They will generally be used in cases of sunken slabs or extensive slab breakage. Before making any asphalt repairs to rigid pavements, the surface must be well cleaned and tacked with a paving asphalt or emulsion to ensure a good bond between the PCC surface and the asphalt concrete or pre-mix overlay.

When making asphalt concrete repairs to PCC, base repairs are very seldom necessary. It is only in an extreme case such as pavement blowups that a PCC pavement should be replaced in its entirety with an asphalt type pavement. Because of the time required for PCC curing and, consequently, interference with traffic, small areas of broken concrete that must be replaced are usually replaced with asphalt material.

Refer to Chapter B for asphalt repairs to rigid pavement. The work is similar whether the pavement is flexible or rigid.

B.08 Portland Cement Concrete Patching with Concrete

Where it is not practical to repair a concrete surface with asphaltic material, permanent repairs should be made, by removing broken sections and replacing them with PCC. High early strength cement should be used. In some instances 1 1/2 percent of calcium chloride may be added to hasten the setting time of the patch. There are also several proprietary rapid-setting products available for patching.

Where fresh concrete is to be placed against old concrete, and when spalled joints are being repaired, a more effective joint can be obtained by using an adhesive consisting of modified epoxy resin applied to the edges of the old concrete immediately before the fresh concrete is placed. In repairing PCC pavement with new concrete, allow ample time to permit the new concrete to set prior to opening the section to traffic. With high early strength concrete this will generally be 24 hours.

B.09 Portland Cement Concrete Joint and Crack Seal

Generally, sawed joints in PCC pavements should be filled. Contact the District Material Laboratory if a faulting condition develops at transverse joints. The Lab will study the condition and make recommendations. Any random cracks should be filled before the winter rains.

Cracks or joints in PCC pavements may be filled with any of a variety of commercially available crack fillers.

Do not overfill cracks, as a build-up of filled material results in bumps that are noticeable to traffic.

Joints between the concrete and asphalt shoulders are generally filled with a mixture of emulsion and rejuvenator and topped off with sand.

Refer to the "Flexible Pavement Joint and Crack Sealing" section in Chapter A, as this work is similar whether the pavement is flexible or rigid.

B.10 Portland Cement Concrete Base Reinforcement by Mudjacking

Mudjacking may be used to re-establish the base under PCC slabs without removing the slabs. In addition to base reinforcement, sunken slabs may sometimes be raised to grade by this method. Mudjacking literally replaces lost or sunken base material by pumping a Portland cement grout underneath the slab. The grout is pumped through holes drilled into the slab at required intervals. Special pumping equipment is needed for this purpose.

The material used in mudjacking should have a low shrinkage factor, good strength and the ability to flow through the equipment and spread under the pavement. A grout consisting of 1 part Portland cement, 3 parts pozzolan and 1.4 to 2.4 parts water should be used.

Mudjacking is a special process and is generally performed by specialized crews.

B.11 Portland Cement Concrete Slab Base Reinforcement by Subsealing

Cavities under sunken or moving slabs may be filled by subsealing with asphalt. This practice has not been used often in past years. However, if it is determined that this method should be used, consult the District's Materials Lab for specification and advice regarding this maintenance practice.

B.12 Portland Cement Concrete Grinding

Irregular surfaces in Portland cement concrete pavement are often corrected by grinding. This works well for correcting the riding qualities of a pavement that has faulted. Grinding projects are generally done by contract. When it is felt that grinding is the solution to correcting irregularities in concrete pavement surfacing, the problem should be brought to the attention of the District Division Chief of Maintenance and Operations. Extensive grinding work is generally considered as reconstruction and is not a maintenance charge; however, isolated small areas may be classified as maintenance.

B.13 Work on Asphalt Shoulders

Due to the hazards of traffic, work on paved asphalt shoulders should be confined to one side of the highway at a time. Workers shall be given protection while working on paved shoulders as outlined in Chapter 8 of this Manual.

B.14 Road Approaches to Public Roads

Refer to " Chapter A, Section A.21 for definition of Road Approaches to Public Roads.

B.15 Bicycle Paths

Refer to Chapter A, Section A.22 for detailed instruction regarding bicycle paths.